Executive Summary

Football is one of the most popular sports all over the world. This popularity has boosted the investments in applying new technologies in the game. Many of these technologies are focused on assisting the referee in taking game decisions such as the video assistance referee and automatic goal detection. However, refereeing a game is still vulnerable to human error from the referees. This human error can result from the referees' limited view in real game time, their own interpretation of a game situation and the pressure from the teams and supporters. TU Eindhoven aims at developing a system that can monitor the game in real time and make fair autonomous decisions. This project is a step towards this goal.

Our task was to design an autonomous referring system for Robocup middle size league (MSL) using drones. Our deliverables were: a) System Architecture definition, b)Drone refereeing system and c)Wiki page.

For the architecture part, CAFCR was used to capture concerns and drivers from stakeholders. From these concerns we have formulated the functions of the system. Regarding the system structure, we have defined the general abstract referee aiding system (RAS) package. While, the package MSL is a sub-package of RAS to describe the system under development.

As for the drone referring system, the system was able to provide the remote referee with live feed from the field via camera mounted on the drone, give recommendation for ball positions and get commands from the MSL base station. The system consisted of several subsystems, like : Avular curiosity drone, High level controller, Localization, Action planner, Human machine interface, Camera, Monitoring and World model. Some of them are only in software, as such; the true challenge was the integration.

A simulation environment was developed to test the system before hardware trials. In this simulation, physical subsystems were replaced with software models and the game was represented by log files for robot and ball positions. The visual test environment was developed using Unity and Matlab. The results of the simulation can be accessed through this link.

Like any development project, we faced the usual hardware problems like late delivery and bugs. As such we could not use the drone to fly over the pitch. However, we performed another simulation with the drone acting as a hardware in loop (HIL) and the actual MSL robot players (turtles) passing the ball. The result of the final HIL simulation can accessed through this <u>link</u>.

Finally, we have documented our work in form of wiki page. If you follow this <u>link</u> you reach the wiki page.